

THE SUSTAINABILITY OF INDIANA'S FOREST RESOURCES

A photograph of a logging operation in a forest. In the foreground, a red logging truck is loaded with several large logs. Some of the logs have blue markings on them. In the background, a yellow skidder is visible, and a person is standing near a large log on the ground. The forest is lush with green trees.

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OVERVIEW

This report presents a forest resource sustainability analysis based on data gathered by the Forest Inventory & Analysis (FIA) program, which is part of the Forest Service within the United States Dept. of Agriculture. This data pertains to the forest resources of Indiana and addresses the issue of sustainable forestry being practiced. The FIA program was first implemented in Indiana in 1950 (Hutchison 1956). Subsequent periodic inventories were completed in 1967, 1986, and 1998 (Spencer 1969, Spencer et al. 1990, Smith and Golitz 1988, Schmidt et al. 2000). An annual inventory was begun in 1999, allowing dynamic monitoring of Indiana's forest resources with comprehensive reports published every 5-years (Woodall et al. 2005). The results presented in this report are estimates based on sampling techniques presented by Bechtold and Patterson (2005). Data from Indiana's annual forest inventory and most periodic inventories may be accessed through the FIA Mapmaker program web site at <http://ncrs2.fs.fed.us/4801/fiadb/index.htm>.

Since 1999, the forests of Indiana were inventoried using an annual inventory system. The total sample of plots was systematically divided into five interpenetrating, nonoverlapping subsamples or panels. Each year the plots in a single panel are measured, and panels are selected on a 5-year, rotating basis (McRoberts 1999). For estimation purposes, the measurement of each panel of plots may be considered an independent systematic sample of all land in Indiana. Field crews measure vegetation on plots forested at the time of the last inventory and on plots currently classified as forest by trained photointerpreters, who make their assessment on the basis of aerial photos or digital orthoquads. Such an inventory system allows for annual estimates of forest resource attributes such as area, growth, and removals.

For a detailed explanation of sample layout, collection protocols, and glossary terms, please review Part B of the latest Forest Service publication covering the Indiana inventory (Woodall et al. 2006).

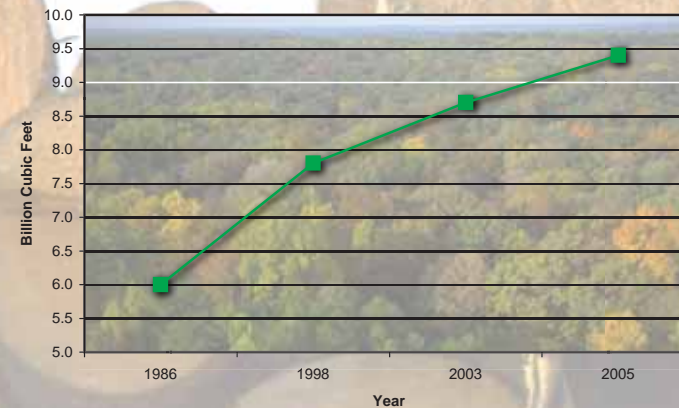
RESULTS

Area

In 2005, forestland area (including reserved or low-productivity land) totaled over 4.7 million acres. Private landowners own approximately 83 percent of the forestland with the remainder belonging to public agencies. Hardwoods occupied nearly 97 percent of this area, with the remainder classified as softwoods or nonstocked. Of this 97 percent hardwood, oak-hickory forests constitute 59 percent although the maple-beech-birch group holds a strong second place.

Timberland area has continued to increase since the 1967 inventory, with steady

Figure 1. Net Volume of All Live Trees on Forestland in Indiana 1986-2005

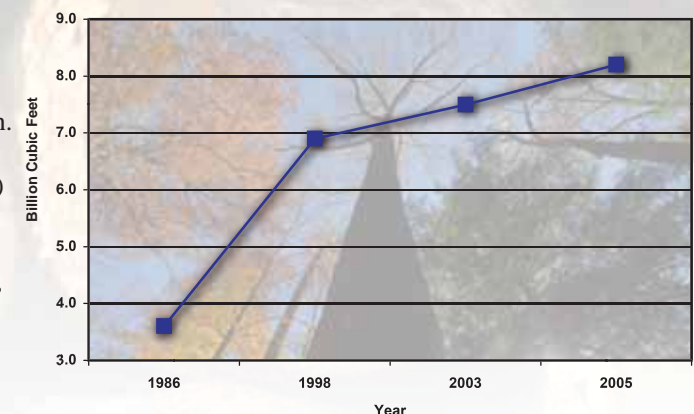


hardwood forests managed primarily with single-tree selection harvest methods, as is common in Indiana.

Volume

In 2005, the net volume of all live trees on forestland, which includes growing stock, rough, and rotten trees, was nearly 9.4 billion cubic feet. Hardwoods constituted the majority with nearly 9.1 billion cubic feet. This indicates a considerable and steady increase over the 1986, 1998, and 2003 inventories, which estimated the total cubic foot volume of all live trees as 6.0 billion cubic feet, 7.8 billion cubic feet, and 8.7 billion cubic feet, respectively (Figure 1).

Figure 2. Net Volume of Growing Stock on Timberland in Indiana 1986-2005



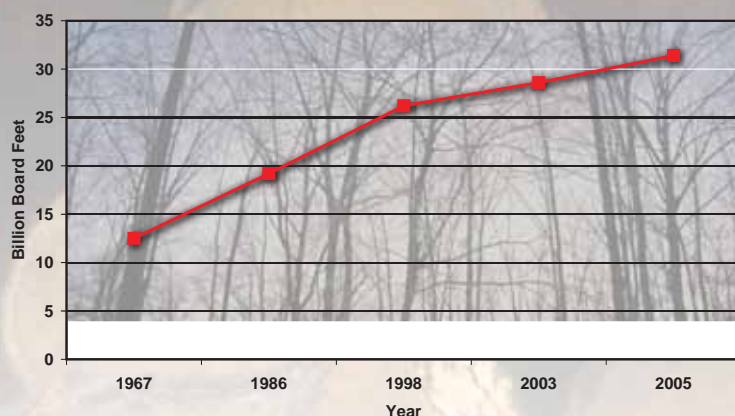
The net volume of growing-stock (trees with a d.b.h. greater than or equal to 5 inches) on timberland in 2005 totaled 8.2 billion cubic feet, more than triple the 2.5 billion cubic feet esti-

increases in the saw timber stand-size class. The area of timberland in the sapling-seedling and pole timber classes has decreased since 1950, indicating the natural development of mature timberland stands. This stand development progression is not unusual for

mated during the 1950 inventory. For the 1986, 1998, and 2003 inventories, the net volume was estimated at 3.6 billion cubic feet, 6.9 billion cubic feet, and 7.5 billion cubic feet respectively (Figure 2). Combining the net volume of growing stock with the area discussion, we can observe the increases of volume per acre of timberland basis as well. Since 1986 the net volume of growing stock per acre of timberland has more than doubled (838 cubic feet per acre in 1986 to 1783 cubic feet per acre in 2005).

The net volume of saw timber (trees with a d.b.h. greater than or equal to 11 inches for hardwoods and 9 inches for softwoods) on timberland in 2005 was nearly 31.4 billion board feet (International ¼-inch rule), more than double the amount of saw timber volume estimated in 1967. This number can be compared with 28.6 billion board feet in 2003, 26.2 billion board feet in 1998, 19.2 billion board feet in 1986, and 12.5 billion board feet in 1967 (Figure 3). Trees that were 19 or more inches in diameter made up 11.0 percent of the softwood saw timber volume and 40.8 percent of the hardwood saw timber volume. In 1986, these proportions were 1.3 percent and 32.6 percent, respectively.

Figure 3. Net Volume of Sawtimber on Timberland in Indiana 1967-2005



Growth, Removals and Mortality

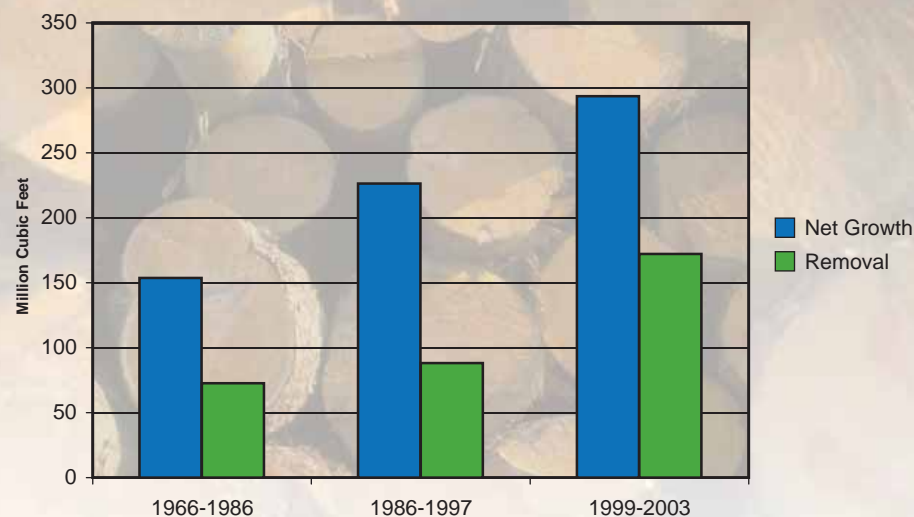
Between 1998 and 2003, the growing stock on Indiana's timberland grew, on average, 380.7 million cubic feet per year. Average annual mortality during this same time was estimated to be 87.1 million cubic feet per year, resulting in a net average growth (gross growth minus natural mortality) of 293.6 million cubic feet per year.

For the same time period, the average annual removals of growing stock on timberland totaled 172.1 million cubic feet per year. Removals are defined as growing stock trees removed for forest products, left as logging residues, or felled for cultural/forest management purposes (e.g., timber stand improvement). Also

classified as removal is volume from all land-use changes permanently removing trees from the timberland base (for example, timberland that becomes reserved forest land or is permanently converted to nonforest use such urban/residential).

With regards to the sustainability of growth, removals, and mortality, a perspective can often be gained by comparing the net growth (growth minus mortality) to removal. A net growth-to-removal ratio of 1.00 indicates that the volume of growth equals that being removed, which is an indicator of forest resource sustainability. A ratio of 2.00 indicates that the volume of growth twice exceeds that of removal. Comparing growth-to-removal ratios among inventories indicates that removals from Indiana's forestland have been conducted in a sustainable manner for a long period of time. Between 1999-2003, the ratio was reported as 1.71 (293.6:172.1). For 1986-1997, the ratio was reported as 2.57 (226.3:88.2) and for 1966-1986 the ratio was 2.12 (153.6:72.6), all above a ratio of 1.00 that indicates a minimum threshold for sustainability (Figure 4).

Figure 4. A Comparison of Net Growth and Removal of Growing Stock in Indiana 1966-2003



SUMMARY

As was found in a comprehensive forest resource assessment in 2003 (Woodall et. al., 2005), the forests of Indiana are expanding and maturing. The inventory and monitoring of Indiana's forests indicates that forestland area and volume have been steadily increasing for decades. Hardwood forests continue to dominate the

majority of Indiana's forests both in terms of acreage and volume. Average annual growth far exceeds removals continuing a long-term trend for Indiana's forests. The greatest risks to Indiana's forest resources are not the rather stable levels of removals across Indiana, but rather the conversion of forests to non-forest conditions (e.g., urban sprawl), advanced stages of stand development, and invasive species/pests (e.g., emerald ash borer). Given these constant forest health threats both to Indiana's forests and those across the Nation, the objective monitoring of Indiana's hardwood forests will ensure their economic viability, productivity and sustainable management into the future

LITERATURE CITED

Bechtold, W.A.; Patterson, P.L. eds. 2005. Forest Inventory and Analysis national sample design and estimation procedures. Gen. Tech. Rep. GTR-80. Asheville, NC: U.S. Department of Agriculture, Forest Service. Southern Research Station. 85 p.

Hutchison, O.K. 1956. Indiana's forest resources and industries. For. Ser. Rep. 10. Washington, DC: U.S. Department of Agriculture, Forest Service. 44 p.

McRoberts, R.E. 1999. Joint annual forest inventory and monitoring system, the North Central perspective. Journal of Forestry. 97(12): 27-31.

Miles, Patrick D. Nov-06-2006. Forest inventory mapmaker web-application version 2.1. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. [Available only on internet: www.ncrs2.fs.fed.us/4801/fiadb/index.htm]

Schmidt, T.L.; Hansen, M.H.; Solomakos, J.A. 2000. Indiana's forests in 1998. Resour. Bull. NC-196. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 139 p.

Smith, W.B.; Golitz, M.F. 1988. Indiana forest statistics, 1986. Resour. Bull. NC-108. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central

Forest Experiment Station. 39 p.

Spencer, J.S. 1969. Indiana's timber. Resour. Bull. NC-7. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 61 p.

Spencer, J.S.; Kingsley, N.P.; Mayer, R.V. 1990. Indiana's timber resource, 1986: an analysis. Resour. Bull. NC-113. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 85 p.

Woodall, C.W.; Johnson, D.; Gallion, J.; et al. 2005. Indiana's forests, 1999-2003, part A. Resour. Bull. NC-253A. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 95 p.

Woodall, C.W.; Hansen, M.; Brand, G.; McRoberts, R.; Gallion, J.; Jepson, E. 2006. Indiana's forests, 1999-2003, part B. Resour. Bull. NC-253B. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 86 p.

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